

Standard Operating Procedures for Examining Friction Ridge Prints

1 Introduction

Friction ridge print examinations are conducted using a process known as Analysis, Comparison, and Evaluation, which includes an assessment of the quantity and quality of the information present.¹ The steps of Analysis, Comparison, and Evaluation are applied to friction ridge prints, as appropriate. The comparison and evaluation of two areas of friction ridge prints are based on the examination of ridge flow; ridge paths, including the location, direction, and spatial relationships of minutiae; and ridge structure and pores. The following are the fundamental principles for these examinations:

- The morphology of friction ridge skin is unique.
- The arrangement of friction ridges is persistent.
- During contact with a surface, the details of friction ridge skin may be transferred.
- A print that contains sufficient quality and quantity of friction ridge detail can be identified to, or excluded from, a source.²
- No predetermined number of friction ridge details is required to establish a conclusion.

Throughout all Friction Ridge Discipline level two documents and case records, the terms *Source Identification* and *Source Exclusion* are interchangeable with the terms *identification* and *exclusion*, respectively.

2 Scope

These procedures apply to all personnel who conduct friction ridge print Analysis, Comparison, and Evaluation examinations within the FBI Laboratory.

3 Factors Affecting Examinations

The quality and appearance of a print may be affected by various factors when a print is deposited. An examiner must consider these factors when determining the tolerance for variation in the appearance of friction ridge features. Failure to properly assess these factors may result in a misinterpretation of the data. These factors must be considered in all phases of Analysis, Comparison, and Evaluation, when applicable and available.

¹ SWGFAST Document #10 Standards for Examining Friction Ridge Impressions and Resulting Conclusions (Latent/Tenprint), Ver 2.0, Issue Date 03/13/2013.

² Source refers to the area of friction ridge skin.

3.1 Anatomical Aspects

- Possible areas of friction skin
- Additional friction ridge prints on the same item
- Condition of friction skin

3.2 Transfer Conditions

- Pressure applied during transfer
- Slippage or twisting
- How an item may be handled

3.3 Transfer Medium

- Eccrine
- Sebaceous
- Blood
- Paint
- Dirt
- Corrosives
- Oil/grease
- Other

3.4 Detection Method

- Visual
- Forensic light source
- Chemical
- Powder

3.5 Substrate

- Porous
- Non-porous
- Semi-porous
- Textured
- Adhesive

3.6 Environmental

- Protected
- Unprotected
- Wet (excessive)
- Hot (excessive)
- Dry (excessive)

3.7 Preservation

- Lifting
- Casting
- Photography
- Digital capture

4 Levels and Uses of Friction Ridge Print Detail for Examinations

Friction ridge print detail refers to the information present in a print. The information can be classified into three levels of detail. An examiner will assess the information to determine the quality and quantity of information detected in the print. This information must be considered in all phases of Analysis, Comparison, and Evaluation, when applicable and available.

4.1 Level One Detail

- Overall ridge flow
- General morphology (e.g., overall size)
- Used for pattern interpretation to determine anatomical source (i.e., finger, palm, foot, toe) and orientation
- Not used alone to identify

4.2 Level Two Detail

- Individual ridge path
- Presence of a ridge event
 - Type of ridge event (e.g., ending ridge, dividing ridge, or dot)
 - Direction of ridge event
 - Location of ridge event
 - Spatial relationship of ridge events
- Absence of ridge events (e.g., continuous ridge)
- Combination of ridge events
- Used in conjunction with level one detail to form a conclusion

4.3 Level Three Detail

- Structure of individual ridges (e.g., size, edge shapes)
- Relative pore position
- Other specific friction ridge skin morphology (e.g., ridge breaks)
- Used in conjunction with level one and level two detail to form a conclusion

4.4 Other Features Associated with Friction Ridge Prints (e.g., creases, scars, warts, paper cuts, blisters)

- May be permanent or temporary
- May exist as level one, two, and/or three detail
- May be used in conjunction with friction ridge detail to form a conclusion

Because the appearance of level three detail and/or other friction ridge print features (Section 4.3 and Section 4.4) are highly variable depending on deposition pressure and other factors, these details may be used to support a conclusion only when the corresponding area of the friction ridge print is reliable and with similar deposition pressure as the exemplar. If the details are significantly relied upon to reach a conclusion, the examiner must check all available known prints on file to determine whether the details utilized to support a conclusion are reliably and consistently reproduced and the details must be recorded.

5 Procedures for Friction Ridge Print Examinations (Analysis, Comparison, and Evaluation)

Friction ridge print examinations are conducted using Analysis, Comparison, and Evaluation, which is applicable to all friction ridge examinations (i.e., unknown to known, known to known, or unknown to unknown). Analysis, Comparison, and Evaluation is a process in which the examiner continually assesses the specificity and/or rarity of features and any similarity/dissimilarity between two prints. Throughout Analysis, Comparison, and Evaluation, the examiner may re-analyze the friction ridge print.

5.1 Analysis

Analysis is the primary examination of a friction ridge print by an examiner, in which the quality and quantity of information, including the specificity and/or rarity of features and their relationships, are assessed in addition to tolerance for variations in appearance.

A print is suitable for comparison when the examiner determines that sufficient reliable information may be present, such that an identification decision could be reached. A print is suitable for comparison when the observed information contains enough specificity and/or rarity that the examiner would not expect to see that same amount of information repeated in a different source.

If the print lacks sufficient reliable information such that an identification decision to any source would not be considered possible, the print is not suitable for comparison.

An examiner must conduct and record a thorough analysis on a friction ridge print(s) before he/she conducts comparisons using the print(s).

Note: While “suitable for comparison” is preferred, the term is synonymous with “claimed” which can be used as needed.

5.1.1 Analysis Procedure

The examiner observes the print and may use a magnifier, microscope, macroscope, digital imaging software, or other tools, when necessary. The examiner determines if the print is from

friction ridge skin and, if so, analyzes the print considering the information outlined in Sections 3 and 4.

If a print is suitable for comparison, the examiner will move to the next step in the process, comparison, as applicable.

5.1.2 Analysis Records

Sufficient level two detail to support a suitable for comparison decision must be recorded on an image of the print prior to conducting a comparison. If level three detail is a significant factor in deeming the print suitable for comparison, the level three detail relied upon to reach that decision must also be recorded. See Section 5.1.2.1 for exception for standard intentionally recorded prints.

5.1.2.1 Analysis Recording - Images

If the print is suitable for comparison, the examiner will orient the print in the correct anatomical position, if known, and indicate the type (e.g. fingerprint, palm print, toe print). Due to the nature of the record, orientation, type, and level two or three detail are not required for standard intentionally recorded prints (e.g., ten print card, fingerprint strip, major case prints). Non-standard intentionally recorded prints (e.g., single print on license or notary book) will require the orientation, type, and level two or three detail recorded.

5.1.2.2 Analysis Recording – Case Record

The case record must include the number and type of prints that are suitable for comparison for each item, as well as an indication of any items(s) for which there are no prints suitable for comparison. Unless otherwise noted in the case record, standard intentionally recorded prints are assumed to be suitable for comparison if used for a comparison.

The case record must also include a record of any friction ridge print not analyzed. The contributor will be notified that prints were not analyzed and are available for future requests as needed. With the exception of known records and unless otherwise noted in the case record, all suitable for comparison prints are assumed to be latent prints.

5.1.3 Change in Analysis

Throughout Analysis, Comparison, and Evaluation, the examiner may re-analyze the friction ridge print based on new friction ridge information (such as through consultation) or new interpretations of previous information.

5.1.3.1 Change in Analysis Disagreements for Not Reported Prints

If an examiner determines that a suitable for comparison print lacks sufficient reliable information such that an identification decision to any source would not be considered possible, and the print(s) has not been reported, the analysis decision can be changed with no approval or extra records required. The marked image will be retained in the case record.

No additional measures will be taken if an examiner changes the analysis of a print deemed not suitable for comparison.

If another examiner had made the original decision, the change will not be addressed by the FBI Laboratory Operations Manual, Practices for Resolution of Scientific or Technical Disagreement and the FBI Friction Ridge Discipline Quality Assurance Manual, Procedures for Disagreements in Technical Casework as the change would not fall under the conditions of those documents.

5.1.3.2 Change in Analysis Disagreements for Previously Reported Prints

If an examiner determines that a suitable for comparison print lacks sufficient reliable information such that an identification decision to any source would not be considered possible, and the print(s) has been previously reported, the examiner will do the following:

- For a suitable for comparison print(s) (or claimed print) that has been reported, expanded analysis documentation and supervisory approval is required (e.g., digital markups).
- For a print(s) that has been reported as of value, supervisory approval is required.

In addition, if the print(s) had been previously reported by another examiner currently employed in the FBI Friction Ridge Discipline, changes in analysis will be handled as follows:

- Uncompared print(s) and print(s) previously reported as inconclusive due to the latent will require a discussion with the original examiner. The discussion and conclusion will be noted in the case record. The previous report will be amended as needed. The change will not be addressed by the FBI Laboratory Operations Manual Practices for Resolution of Scientific or Technical Disagreement and the FBI Friction Ridge Discipline Quality Assurance Manual, Procedures for Disagreement in Technical Casework as the change would not fall under the conditions of those documents.
- Prints with any other reported conclusion (e.g., identified, excluded, inconclusive due to the known, or automated search results) will require disagreement resolution with the original examiner. The previous report will be amended or supplemented as needed.

If the original examiner is no longer employed in the FBI Friction Ridge Discipline, no disagreement discussions will occur. The previous report will be amended or supplemented as needed.

If an examiner determines that a not suitable for comparison print should now be suitable for comparison, no additional measures will be taken. The change will not follow the FBI Laboratory Operations Manual Practices for Resolution of Scientific or Technical Disagreement and the FBI Friction Ridge Discipline Quality Assurance Manual, Procedures for Disagreement in Technical Casework as the change would not fall under the conditions of those documents.

5.1.4 Intentionally Recorded Prints

See Section 5.1.2 through Section 5.1.2.2 for analysis record requirements for intentionally recorded prints.

An examiner using a known exemplar(s) for examinations must record which prints were used. Examples of acknowledgement include initialing a copy of the known exemplar(s), associating a secure electronic signature with the exemplar, or assigning a unique identifier to each card and recording the appropriate identifier in the case record.

For acceptance requirements of non-original intentionally recorded prints, refer to the FBI Friction Ridge Discipline Quality Assurance Manual, Procedures for Case Acceptance.

5.2 Comparison

Comparison is the side-by-side observation of suitable for comparison friction ridge prints to determine whether the information observed during analysis is in agreement or disagreement between two prints. When determining if features correspond, an examiner considers variation in the appearance of the friction ridge prints that may be attributed to the factors listed in Section 3. Throughout the comparison process, the examiner may re-analyze the prints being compared. (See Section 5.1.3)

5.2.1 Comparison Procedure

1. The examiner compares the corresponding area between two friction ridge prints. If a suitable for comparison print is determined to be an impression, all appropriate areas of the available known prints must be compared, unless otherwise noted. When comparing a latent print to a known print, the examiner will begin the comparison process with the latent print. Evaluation decisions are clarified in Section 5.3.
2. If appropriate, the examiner determines if a sufficient amount of level one detail is in disagreement for exclusion.
3. If a print cannot be excluded based on level one detail, additional detail must be compared.

4. The examiner selects a target group in a friction ridge print and searches for it in the comparable area of the second friction ridge print. If the initial target group is not found, alternative target groups may be selected.

5. If similarity with the target group is found, the examiner continues comparing ridges in sequence until a sufficient amount of agreement of friction ridge detail allows the examiner to support an identification conclusion. If similarity with the target group is not found, the examiner continues comparing friction ridge detail until a sufficient amount of disagreement of friction ridge detail allows the examiner to support an exclusion conclusion. 6. If after comparison of all relevant comparable areas, neither sufficient agreement nor sufficient disagreement of friction ridge details can be observed, the examiner may form an inconclusive conclusion.

6. During comparison, the examiner may change the original analysis conclusion. If a change is made, the examiner must clearly record the change in the case record. (See Section 5.1.3.)

5.3 Evaluation

Evaluation is the formation of a conclusion based on the examiner's observations, assessments, and records generated during the analysis and comparison of the friction ridge prints. The observation and assessment refers to the examiner's interpretation of the information found to be either in agreement or disagreement between two prints in order to come to a conclusion. The conclusion is supported by the examiner's ability to assess the specificity and/or rarity of information present within the print. The possible conclusions are as follows:

- Identification
- Exclusion
- Inconclusive
 - Known
 - Latent (also applies to non-standard intentionally recorded prints)

5.3.1 Identification

Identification is an examiner's conclusion that two friction ridge prints originated from the same source. The conclusion is an examiner's decision that the observed friction ridge skin features are in sufficient correspondence such that the examiner would not expect to see the same arrangement of features repeated in a print that came from a different source and has found insufficient friction ridge skin features in disagreement to conclude that the prints came from different sources.

The basis for an identification conclusion is an examiner's decision that the observed corresponding friction ridge skin features provide extremely strong support for the proposition that the two prints came from the same source and extremely weak support for the proposition that the two prints came from different sources.

An identification is the statement of an examiner's opinion (an inductive inference³) that the probability that the two prints were made by different sources is so small that it is negligible. An identification is not based upon a statistically-derived or verified measurement or actual comparison to all other friction ridge print features. While an identification to the absolute exclusion of all others is not supported by research, an identification conclusion is supported by:

- the biological premise that friction ridge skin is persistent and unique,⁴
- population studies that have assessed the frequency of features,⁵ and
- statistical models, which have demonstrated that as more reliable features are found in agreement, it becomes less likely to find that same arrangement of features in a print from a different source.⁶

Level three detail may be used to support a conclusion only when the corresponding areas of the prints are reliable.

5.3.1.1 Recording an Identification

If the print is identified to a known source, the annotated image will indicate that an identification was effected, correct anatomical source designation (e.g., finger #, left/right palm/foot), and last name or unique identifier (e.g., Universal Control Number (UCN)) of the individual. Additional information may be needed if the last name is not unique to the case record.

The use of level three detail to effect a conclusion must be recorded in the case record.

If a latent to latent comparison results in an identification, the conclusion must be recorded on both images.

5.3.2 Exclusion

Exclusion is an examiner's conclusion that two friction ridge prints did not originate from the same source. The basis for an exclusion is an examiner's decision that the observed friction ridge skin features are in sufficient disagreement and provide extremely strong support for the

³ "By the process of induction or inference, predictions about new situations are inferred or induced from the existing body of knowledge. In other words, an inference is a generalization, but one that is made in a logical and scientifically defensible manner." Oxford Dictionary of Forensic Science 130 (2012).

⁴ ---- (2011). National Institute of Justice. The Fingerprint Sourcebook. (www.nij.gov/pubs-sum/225320.htm) Chap. 2-3; Wertheim, K., & Maceo, A. (2002). The Critical Stage of Friction Ridge and Pattern Formation. *Journal of Forensic Identification* 52(1): 35-85

⁵ Gutierrez, E.; Galera, V.; Martinez, J. M.; and Alonso, C. (2007). Biological Variability of the Minutiae in the Fingerprints of a Sample of the Spanish Population. *Forensic Science International* 172:98-105; Gutierrez-Redomero, E.; Alonso-Rodriguez, C.; Hernandez-Hurtado, L. E.; and Rodriguez-Villalba, J. L. (2011). Distribution of the Minutiae in the Fingerprints of a Sample of the Spanish Population. *Forensic Science International* 208:79-90.

⁶ Neumann, C. et al (2012). Quantifying the weight of evidence from a forensic fingerprint comparison: a new paradigm. *Journal of the Royal Statistical Society*, Vol. 175, pp. 371-415.

proposition that the two prints came from different sources and extremely weak or no support for the proposition that the two prints came from the same source.

5.3.3 Inconclusive

Inconclusive is an examiner's conclusion that there is insufficient quantity and/or clarity of corresponding friction ridge skin features between two prints such that the examiner is unable to identify or exclude the two prints as originating from the same source. The basis for an inconclusive conclusion is an examiner's decision that an identification or exclusion cannot be made due to insufficient information in either of the two prints examined.

5.3.3.1 Known Inconclusive

A known inconclusive conclusion can be rendered due to insufficient information in the known print. For example, if the print to be compared is from the tip or lower joint of a finger and the corresponding area is not fully captured on the available exemplar(s), or the corresponding area is unusable (e.g., due to distortion), then a known inconclusive conclusion would be reached. Additional recordings from the compared individual may allow for a conclusive decision to be reached.

A known inconclusive conclusion is not used if the corresponding exemplar(s) is not available. For example, if the print to be compared is a palm print and no known palm prints are available for an individual, a known inconclusive conclusion is not appropriate. Instead, the examiner will record the absence of known palm prints in the case record.

If the print to be compared is an impression, the comparison conclusion will be specific to the type of known prints available (e.g., one latent impression is not a fingerprint of JOHN DOE. No palm prints are available for DOE.).

A known inconclusive conclusion will be denoted in the case record as "inconclusive" with no additional explanation.

5.3.3.2 Latent Inconclusive

A latent inconclusive conclusion can be rendered due to insufficient information in the latent print or a non-standard intentionally recorded print. This conclusion is appropriate if the examiner is unable to identify or exclude the prints as having come from the same source and the following two conditions are met:

- additional recordings from the compared individual are not expected to allow for a conclusive decision to be reached AND
- The latent print may still contain sufficient reliable information such that an identification decision to another individual could be reached.

A latent inconclusive decision is not appropriate if it is determined that the latent print is no longer suitable for comparison (i.e., no longer contains sufficient information for an identification to any individual). Instead, the examiner will record a change in the analysis of the print as written in Sections 5.1.3 through 5.1.3.2.

If the examiner reaches a latent inconclusive decision, he/she will be required to add additional explanation (e.g., latent inconclusive, inconclusive due to latent).

5.3.4 Recording Evaluations

The case notes must contain a record of the evaluation conclusion reached for all prints. Case notes will indicate if the prints are not compared (e.g., latent palm prints in the case but no known palm prints are available).

If a latent to latent comparison is requested, the examiner must clearly record which prints were compared and whether the prints were identified or if no identifications were effected.

The results of known to known comparisons must be captured in the case notes and no Analysis, Comparison, and Evaluation marking is necessary on the original or copies of the exemplar. Case notes will include the conclusion.

5.4 Information to Support Analysis, Comparison, and Evaluation Conclusion(s)

If the data relied upon to support the evaluation conclusion are different from the information initially recorded during analysis, the examiner must record the new information. The case record must clearly indicate at what stage the recorded information was observed (e.g., analysis or comparison). The examiner may need to use multiple images to record his/her Analysis, Comparison, and Evaluation process, with each image clearly marked with the stage(s) of information (e.g., writing “analysis” on a second analysis image or adding “comparison” to asset information in a digital image). If multiple images are used, the examiner must compare the data observed in the initial analysis to the data relied upon to support the final analysis and evaluation conclusion.

5.4.1 Records - Images

A copy of all latent print images captured by FBI personnel must be retained, with the exception of images deemed “test” or “exploratory” per the FBI Friction Ridge Discipline, Standard Operating Procedures for Digital Images. If produced, a negative will be retained along with any required digital images. All annotated images must be retained, regardless of whether the print was determined to be suitable for comparison. If used for comparison, a legible reproduction of the known exemplar(s) must be retained in the case record.

6 Verification and Blind Verification

Refer to the FBI Friction Ridge Discipline Quality Assurance Manual, Procedures for Verification and Blind Verification for definitions and specific procedures and their application.

7 Supervisor Review

A Supervisor may deem it necessary to review the casework of any examiner in his/her unit for all or part of a case that has not yet been reported. These examinations are referred to as a Supervisor review and are recorded in the case record. The record will show what was reviewed in addition to the Supervisor's name and the date(s) of the review. The Supervisor must retain any additional records he/she generates in the case record.

8 Consultation

A consultation is a significant interaction between examiners regarding one or more prints in question.

An interaction is considered significant when the consultant examiner conducts an analysis or comparison of the print(s). The commonality of the examples below is that they include, at a minimum, an analysis of the print(s), and may also include a comparison and evaluation.

Examples of significant interactions that rise to the level of consultation include:

- Determination of suitability for comparison in analysis
- Presence of significant distortions impacting the analysis or comparison
- Presence of specific features during the analysis or comparison
- Whether an examination is complex or non-complex

Discussions falling below the level of a significant interaction usually involve minimal (or no) analysis. In addition, they typically have less potential to impact the key decision stages of Analysis, Comparison, and Evaluation and are often related to case efficiency, strategy for workflow, or case management. Examples of discussions that do not rise to the level of consultation include:

- Suitability for Next Generation Identification system and/or its parameters
- Administrative decisions such as triage (e.g., prioritizing prints for examination)
- Searching efficiency (search smart clues)
- Processing choices
- Anatomical origin
- Orientation

Only consultations must be recorded in the case record. The case record will clearly describe what the examiner consulted on as well as the consultant's name and the date of consultation.

Any new examination records created as a result of consultation must be retained in the case record. Discussions or other communications that do not reach the level of a consultation do not need to be recorded.⁶

9 Complex Analysis or Conclusion

When dissimilarities or factors influencing the quality of a latent print are present, and their presence could interfere with the proper interpretation of the print, the resulting analysis or evaluation conclusion may be considered complex.

Some factors that may result in a complex analysis or evaluation conclusion include irregular substrate, excessive deposition and/or lateral pressure, and limited level two detail. The factors leading to a complex analysis or conclusion and an explanation of any differences will be recorded and supported in the case record.

10 Limitations

The presence of a friction ridge print on an item of evidence indicates contact was made between the source and the item. The presence of a friction ridge print alone does not necessarily indicate the significance of the contact or the time frame during which the contact occurred.

Due to a variety of factors, the recovery of friction ridge prints on items of evidence is not always successful. A lack of friction ridge prints on an item or the exclusion of a friction ridge print from a given source does not necessarily mean that the given source did not come into contact with the item.

See FBI Friction Ridge Discipline Quality Assurance Manual, FBI Approved Standards for Scientific Testimony and Report Language for the Friction Ridge Discipline, Latest Revision.

11 Equipment/Materials/Reagents

Magnifiers

Ridge Counters (or dissecting needles)

Marking Pens

Microscopes/Macrosopes

⁶ SWGFAST Document #21 Standards for Consultation (Latent/Tenprint) DRAFT FOR COMMENT, Ver 1.0, Issue Date 03/14/2013.

Digital Imaging Systems

12 Calculations

Not applicable.

13 Measurement Uncertainty

Not applicable.

14 Standards and Controls

Not applicable.

15 Sampling

Not applicable.

16 Safety

Not applicable.

17 References

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FBI Friction Ridge Discipline Quality Assurance Manual, Procedures for Disagreement in Technical Casework, Federal Bureau of Investigation, Laboratory Division. Latest Revision.

FBI Friction Ridge Discipline Quality Assurance Manual, Procedures for Verification and Blind Verification, Federal Bureau of Investigation, Laboratory Division. Latest Revision.

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Scientific Working Group for Friction Ridge Analysis, Study, and Technology. Document #8
Standard for the Documentation of Analysis, Comparison, Evaluation, and Verification (ACE-V)
(Latent), Latest Revision.

Scientific Working Group for Friction Ridge Analysis, Study, and Technology. Document #10
Standards for Examining Friction Ridge Impressions and Resulting Conclusions
(Latent/Tenprint), Latest Revision.

Scientific Working Group for Friction Ridge Analysis, Study, and Technology. Document #19
Standard Terminology of Friction Ridge Examination (Latent/Tenprint), Latest Revision.

Scientific Working Group for Friction Ridge Analysis, Study, and Technology. Document #21
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Rev. #	Date	History
11	08/21/19	Minor wording modifications throughout document. Section 5, Heading changed. Section 8.3.3.2, parentheses added. Section 10, Remove checks to Training documents and broaden Supervisor Check to unit.
12	04/17/20	Latent Print Units changed to Friction Ridge Discipline throughout document as well as other appropriate changes with similar terms. Minor wording, grammar, reorganization of material, and punctuation changes in document. Reorganized sections and renumbered and renamed as appropriate. Section 5.1.2.2, added clarification. Section 5.2.1, updated to better mirror process. Updated Section 5.3.1, Section 5.3.2, and Section 5.3.3 to correspond with updated Department of Justice document. Section 5.3.1.1, generalized to unique identifier. Section 5.4, clarification added. Section 6, removed last paragraph. Section 8, added example.

Approval

Redacted - Signatures on File

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Technical Leader

Date: 04/16/2020

Latent Print Operations
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